

# ALUMINUM

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**Domestic survey data and tables were prepared by Lauri Watson, statistical assistant, and the world production table was prepared by Linder Roberts, international data coordinator.**

In 2002, 7 domestic companies operated 16 primary aluminum reduction plants in 13 States and produced more than 2.7 million metric tons (Mt) of metal. Smelters east of the Mississippi River accounted for 75% of the production. The value of production was estimated to be \$3.9 billion. Three additional companies had plants that were idle during the year. The 10 domestic producers had a total of 7 smelters that were either temporarily or permanently idled in 2002. At yearend, about 1.5 million metric tons per year (Mt/yr) of domestic primary aluminum smelting capacity, equivalent to 35% of total capacity, was closed.

Aluminum recovered from purchased scrap decreased slightly to 2.93 Mt. Of this recovered metal, 60% came from new (manufacturing) scrap, and 40% came from old (discarded aluminum products) scrap. Aluminum used beverage cans (UBCs) accounted for more than one-half of the reported old scrap consumption in 2002. According to the Aluminum Association Inc. (2003a), the recycling rate for aluminum UBCs was 53.4%.

The transportation and the container and packaging industries remained the largest markets for aluminum products in Canada and the United States in 2002. The transportation industry accounted for 35% of consumption; containers and packaging, 23%; building and construction, 16%; consumer durables, 8%; electrical, 7%; and other uses, 11%.

U.S. imports for consumption increased in 2002 compared with those of 2001. Canada remained the largest shipper of aluminum materials to the United States, followed by Russia. Total exports from the United States in 2002 were at the same level as those in 2001.

The price of primary ingot on the domestic and the international markets fluctuated during the year. The 2002 annual average domestic price decreased by almost 4 cents per pound compared with that of the previous year.

At the end of 2002, world inventories of aluminum, as reported by the International Aluminium Institute (IAI), decreased compared with those of 2001. Inventories of primary metal held by the London Metal Exchange Ltd. (LME), however, increased.

Primary aluminum was produced in 43 countries in 2002. China and Russia surpassed the United States as the world's largest producers. China produced 17% of the world total, followed by Russia with 13%. The United States and Canada each accounted for about 10% of the total world production. World primary metal production increased by 7% compared with that of 2001.

## Production

**Primary.**—Domestic primary aluminum production, which totaled a reported 2,706,582 metric tons (t), increased by 3% compared with that of 2001. Production data were obtained from the 11 domestic producers, all of which responded to the U.S. Geological Survey (USGS) request for production data.

Despite the slight increase in production, most of the domestic primary smelting capacity that had been closed during the previous few years remained closed. At yearend, about 1.5 Mt/yr of U.S. primary aluminum smelting capacity was closed. Of this total, 270,000 metric tons per year (t/yr) was permanently closed and the remainder was classified as temporarily idled. The bulk of the idled capacity was in the Pacific Northwest. Most of the smelters outside this region continued to operate at or near their engineered capacities.

In July, Alcoa Inc. announced a series of primary aluminum smelter closures. Alcoa announced the temporary closure of its 120,000-t/yr primary aluminum smelter in Badin, NC, which had been operating at 90,000 t/yr since September 2000. Metal production at the smelter ceased in mid-August. Alcoa also announced the permanent closure of its 121,000-t/yr Troutdale, OR, facility and a 76,000-t/yr potline at its 320,000-t/yr Rockdale, TX, smelter. Both the Troutdale smelter and the potline at Rockdale, which had been idled previously, were dismantled (Alcoa Inc., 2002g).

Alcoa announced that the company would delay indefinitely the planned restart of Line 1 at its 310,000-t/yr Warrick County, IN, primary aluminum smelter. That line has a capacity of 41,000 t/yr. The smelter had been gradually restarting capacity since a power outage interrupted production in December 2001 (Alcoa Inc., 2002b).

Kaiser Aluminum & Chemical Corp. agreed to sell the property, plant, and equipment at its Tacoma, WA, primary aluminum smelter to the Port of Tacoma. The plant is adjacent to the Blair Waterway, which the Port is redeveloping for use as a container terminal. Under the agreement, the Port of Tacoma would assume responsibility for any necessary demolition and environmental remediation at the site. Production at the 73,000-t/yr facility had been curtailed since mid-2000 (Kaiser Aluminum & Chemical Corp., 2002c).

Glencore International AG purchased Vanalco Inc.'s bankrupt, Vancouver, WA, primary aluminum smelter for \$24 million. The 116,000-t/yr smelter had been idled since August 2000 (Mining Journal, 2002c).

In May, Alcoa began the gradual restart of two potlines (95,000 t/yr) at its Intalco smelter in Ferndale, WA. The 278,000-t/yr smelter had been closed since May 2001 (Alcoa Inc., 2002b).

By June 2002, Columbia Falls Aluminum Co. had reopened three of the five potlines at its 168,000-t/yr smelter in Columbia Falls, MT. The smelter had been closed since January 2001 (Reese, 2002§<sup>1</sup>).

In September, Golden Aluminum Co. announced the restart of one potline at its 168,000-t/yr primary aluminum smelter in Goldendale, WA. The restart increased operating capacity to 50,000 t/yr from 12,000 t/yr (Platts Metals Week, 2002e).

Kaiser filed voluntary petitions for bankruptcy reorganization under Chapter 11 of the Federal Bankruptcy Code in the U.S. Bankruptcy Court for the District of Delaware. Although the filing included certain U.S. subsidiaries through which the company held an interest in foreign operations, it did not include Kaiser's interest in the following offshore facilities: alumina refineries in Jamaica and Australia; the Jamaica Bauxite Company; smelters in Ghana and Wales; and an extrusion plant in Ontario, Canada (Kaiser Aluminum & Chemical Corp., 2002a).

Noranda Inc. and members of the United Steelworkers of America (USWA) at its 250,000-t/yr New Madrid, MO, smelter signed a new 5-year labor agreement. The new contract, which took effect on September 1, 2002, allowed for wage increases each year during the course of the contract, improved pension benefits, and instituted some changes in health care benefits (Noranda Inc., 2002).

Century Aluminum Co. and members of the USWA ratified a 3-year extension to a labor agreement that was set to expire on May 31, 2003. The new agreement, which runs through May 31, 2006, covered workers at Century's Ravenswood, WV, primary aluminum smelter. Terms of the agreement were not disclosed (Century Aluminum Co., 2002).

Alcan Inc. announced plans to close one of two cold mills at its Fairmont, WV, plant. The plant produced light gauge aluminum sheet and foil used in the transportation, packaging, and industrial markets. Alcan anticipated that the mill would be closed in 2003 (Alcan Inc., 2002b).

Kaiser announced the sale of the coating line at its Trentwood, WA, rolling mill to Alcoa (American Metal Market, 2002d). With the sale, Kaiser ceased production of aluminum lid and tab stock for the beverage can industry. In 2000, Kaiser exited the can body stock market at Trentwood. Kaiser anticipated that the Trentwood mill would continue to concentrate on its heat-treat business for the aerospace and general engineering markets (Guerriere, 2002b).

Pechiney purchased the equipment of McCook Metals L.L.C. (Pechiney, 2002c). McCook filed for Chapter 11 bankruptcy protection in August 2001. At yearend, the plate manufacturing and rolling equipment of the Chicago plant was still being held in a warehouse (Brooks, 2002).

Norsk Hydro ASA announced the closure of its Moultrie, GA, aluminum extrusion plant. The plant had 2 extrusion presses and employed 121 workers (Guerriere, 2002a).

Strategic Minerals Corp. (Stratcor), Danbury, CT, closed the aluminum-vanadium master alloy line at the Niagara Falls, NY, plant operated by its subsidiary, U.S. Vanadium Corp. Production will shift to a new facility being built in New Castle, PA, by Stratcor's partner, International Specialty Alloys (American Metal Market, 2002j).

**Secondary.**—Metal recovered from new and old scrap decreased slightly to 2.93 Mt in 2002 (table 3), according to data derived by the USGS from its "Aluminum Scrap" survey. Of the 69 companies and/or plants to which monthly or annual survey requests were sent, 39 responded; they represented 92% of the total scrap consumed, as listed in table 4.

According to figures released by the Aluminum Association Inc., the Can Manufacturers Institute, and the Institute of Scrap Recycling Industries, 53.8 billion aluminum UBCs were recycled in the United States in 2002, for a beverage can recycling rate of 53.4%. For 21 of the past 22 years, the rate has exceeded 50% (Aluminum Association Inc., 2003a).

TST Inc. announced the opening of a secondary smelter in Sweetwater, TX. The smelter was expected to produce aluminum die cast alloys 380, 319, and 356 (Schaffer, 2002b).

Superior Aluminum Alloys announced plans to add a fourth furnace at its secondary aluminum smelter in New Haven, IN. The 2,270-metric-ton-per-month (t/mo) (5-million-pound-per-month) furnace would increase capacity at the plant to about 90,700 t/yr (200 million pounds per year). Under normal operating conditions, the smelter planned to operate three furnaces at capacity and use the fourth furnace as a backup (Platts Metals Week, 2002j).

Production at the new Norsk Hydro remelt facility in Commerce, TX, began on November 15. The plant will have the capacity to produce 90,000 t/yr of aluminum from scrap. Norsk Hydro has a total U.S. remelt capacity of more than 400,000 t/yr with additional plants in Henderson, KY; Monet, MO; Ellenville, NY; Phoenix, AZ; and St. Augustine, FL (Norsk Hydro ASA, 2002b).

Allied Metal Co. purchased the assets of Ares Corp., a closed secondary aluminum smelter in Scottsboro, AL. The plant, which had been shuttered for 18 months, contained a 91-t (200,000-pound) reverberatory furnace. No decision had been made by yearend on the types of alloys to be produced by the new company, Allied Scottsboro LLC (Schaffer, 2002a).

In support of its announced strategy to shift production to locations that would provide improved service for its major customers, Wabash Alloys LLC reported the closure of two of its secondary aluminum smelters and the purchase of another. In June, Wabash closed its Syracuse, NY, smelter. The former Roth Brothers facility had been capable of producing 6,350 t/mo (14 million pounds per month) of specification alloy ingot (Platts Metals Week, 2002k). In November, Wabash announced plans to close its Benton, AR, smelter by yearend. The plant had a reported capacity of 3,630 t/mo (8 million pounds per month) of alloy production. Since 2000, Wabash has also closed facilities in Marietta, PA; Checotah, OK; Russellville, AL; Bellwood, VA; and Milwaukee, WI. Wabash has eight operating facilities located in Cleveland, OH; Wabash, IN; Tipton, IN; Dickson, TN; Steele, AL; Montclova, Mexico; and Mississauga and Guelph, Ontario, Canada (Platts Metals Week, 2002l). Wabash purchased the Steele, AL, facility in September of this year. The former Culp Aluminum Alloys facility had a reported production capacity of 54,400 t/yr (120 million pounds per year) of aluminum alloy (Schaffer, 2002c).

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<sup>1</sup>A reference that includes a section mark (§) is found in the Internet Reference Cited section.

Zemex Corp., the Toronto-based owner of dross processor Alumitech, announced the purchase of Resource Recovery Industries Inc. The Friendly, WV, facility used tilting rotary furnaces to convert dross, residues, and other forms of aluminum scrap into sows. The facility also included a cold processing line that converted mixed residues, such as black dross and saltcake, into concentrates of 85% to 90% metal content (Schaffer, 2002d).

## Consumption

The end-use shipment data reported by the Aluminum Association have been revised to include aluminum product shipments in both the United States and Canada. In 2002, the combined U.S. and Canadian shipments of aluminum products to the transportation industry totaled 3.4 Mt (table 6). Shipments to the container and packaging industry, which was the second largest end-use market, was 2.26 Mt. Total shipments, excluding exports, of aluminum products in 2002 increased about 3% compared with those of 2001.

The weight of the average North American-built family motor vehicle increased by 14 kilograms (kg) (30 pounds) to 1,515 kg (3,340 pounds) in 2002 compared with 1,501 kg (3,310 pounds) in 2001. To hold the weight increases of many new models to a minimum, automakers increased the use of lighter-weight grades and forms of steel, a variety of aluminum alloys, powder metals, and magnesium die-casting alloys in the bodies, structural components, powertrains, suspension systems, and other subassemblies. The average aluminum content of the 2002 family vehicle was 122 kg (268 pounds) compared with 116 kg (255 pounds) in 2001 (Wrigley, 2002).

According to a recent study by Ducker Research Co., the average aluminum content of automobiles was expected to grow to 130 kg (287 pounds) per vehicle across the three major automotive markets of the world by 2010. This included a North American average aluminum content of 144 kg (318 pounds) per vehicle by 2010, a European average of 122 kg (268 pounds) per vehicle, and a Japanese average of 119 kg (263 pounds) per vehicle. Castings have dominated aluminum automotive applications throughout the industry's history, representing nearly 80% of all shipments in the three major world markets. However, during the balance of this decade, other product forms are expected to increase their share, particularly aluminum sheet (Light Metal Age, 2002).

Jaguar Cars Ltd.'s all new XJ sedan, unveiled at the 2002 Paris Auto Show, reportedly is the first volume production vehicle with an aluminum unibody structure. Alcan's Aluminum Vehicle Technology was used to design a stamped sheet structure that is about 40% lighter than an equivalent steel body. All of the car's "hang-on" body parts—hoods, doors, fenders, and trunk lids—are also produced of aluminum, further contributing to weight reduction and improved performance (Alcan Inc., 2002k).

Norsk Hydro announced the development of an all-aluminum engine block for a new high performance diesel engine. Blocks for high performance diesel engines must sustain high temperatures and up to three times the pressure of traditional gasoline engines. Norsk Hydro also approved a major investment for a new production line for aluminum blocks at Dillingen, Germany. Upon completion, the new facility would be capable of producing 350,000 engine blocks per year (Norsk Hydro ASA, 2002d).

Harley Davidson Inc.'s 2003 VRSCA V-Rod is reportedly the first motorcycle produced by a major U.S. manufacturer using aluminum body panels. The 100th Anniversary V-Rod uses anodized aluminum in the cycle's body panels, front and rear fenders, chain guard, louvered front side covers, radiator shroud, airbox cover, and swing arm (Journal of Metals, 2002).

Alcoa received antitrust clearance from the European Union to complete the acquisition of Fairchild Fasteners from The Fairchild Corporation. Fairchild Fasteners was a leading producer of precision fastening systems and components used in the construction and maintenance of commercial and military aircraft (Alcoa Inc., 2002f).

Ball Corporation completed its acquisition of Schmalbach-Lubeca AG, Europe's second largest manufacturer of beverage cans. Schmalbach operated 12 beverage can and can-end manufacturing facilities: four each in Germany and the United Kingdom, 2 in France, and 1 each in the Netherlands and Poland. The facilities, which will be operated under the name Ball Packaging Europe, reportedly had a combined capacity to produce more than 12 billion cans and ends per year (Platts Metals Week, 2002b).

Alcoa introduced a new nonstick aluminum foil, Reynolds Wrap Release. The foil, which is coated with a special proprietary food-safe, nonstick surface, can be used both as a cooking/baking item as well as a wrap for storage. Reynolds Wrap Release will compete in the \$1.7 billion U.S. food wrap and bag industry (Alcoa Inc., 2002h).

## Stocks

Domestic inventories of aluminum ingot, mill products, and scrap held by U.S. producers increased to 1.32 Mt at yearend 2002 from 1.30 Mt at yearend 2001 (Aluminum Association Inc., 2003b). The LME reported, however, that primary aluminum metal ingot at its U.S. warehouses decreased dramatically to 650 t at yearend 2002 from 28,500 t at yearend 2001 and that its U.S. warehouses still did not hold any stocks of aluminum alloy ingot (London Metal Exchange Ltd., 2002).

On March 4, the LME launched a new aluminum alloy contract, the North American Special Aluminium Alloy Contract (NASAAC). It is a modified version of the LME alloy contract with a tighter A380.1 specification (Pinkham, 2002). Delivery points were limited to four U.S. warehouses—Baltimore, MD; Chicago, IL; Detroit, MI; and St. Louis, MO (Platts Metals Week, 2002h). At yearend 2002, these warehouses held 44,200 t of NASAAC ingot (London Metal Exchange Ltd., 2002).

## Prices

The monthly average U.S. market price of primary aluminum metal, as reported by Platts Metals Week, fluctuated throughout the year. The monthly average price began the year at 64.6 cents per pound, reached a low for the year of 62.6 cents per pound in August,

and, by December, had risen to 66.1 cents per pound. The average price for the year decreased to 64.9 cents per pound in 2002 from 68.8 cents per pound in 2001.

The LME average monthly cash price for high-grade primary aluminum ingot and the average monthly spot settlement price for primary aluminum ingot on the COMEX division of the New York Commodity Exchange, Inc. followed the same general trend as the U.S. market price. The 2002 average annual LME cash price was 61.2 cents per pound. The COMEX monthly average spot settlement price declined slightly from 65.1 cents per pound in January to 64.7 cents per pound in December.

Purchase prices for aluminum scrap, as quoted by American Metal Market, also fluctuated but closed at higher levels than those at the beginning of the year. The yearend price ranges for selected types of aluminum scrap were as follows: mixed low-copper-content aluminum clips, 51 to 52 cents per pound; old sheet and cast aluminum, 48 to 49 cents per pound; and clean, dry aluminum turnings, 48 to 49 cents per pound.

Aluminum producers' buying price range for processed and delivered UBCs, as quoted by American Metal Market, also closed higher at yearend. The price range began the year at 44 to 45 cents per pound and closed the year at 49 to 51 cents per pound. Resource Recycling published a monthly transaction price for aluminum UBCs in its Container Recycling Report. During the year, the monthly average fluctuated but closed higher at yearend. The January average was 47.3 cents per pound, and the December average was 52.4 cents per pound. The annual average transaction price for aluminum UBCs, however, decreased to 49.1 cents per pound in 2002 from 50.2 cents per pound in 2001.

The yearend indicator prices for selected secondary aluminum ingots, as published in American Metal Market, also increased compared with those at the beginning of the year. The closing prices for 2002 were as follows: alloy A380 (3% zinc content), 76.2 cents per pound; alloy B380 (1% zinc content), 77.6 cents per pound; alloy A360 (0.6% copper content), 80.5 cents per pound; alloy A413 (0.6% copper content), 80.5 cents per pound; and alloy 319, 79.1 cents per pound. Platts Metals Week published an annual average U.S. price of 70.2 cents per pound for A380 alloy (3% zinc content). The average annual LME cash price for a similar A380 alloy was 56 cents per pound.

In June, the LME started cash trading for the NASAAC. The annual average NASAAC cash price for 2002, based on 6 months of trading, was 65.4 cents per pound.

## Trade

Total exports of aluminum materials from the United States in 2002 were at the same level as those of 2001 (table 8). The decrease in exports of semifabricated material was compensated for by increases in exports of crude metal and alloys and aluminum scrap (table 9). About two-thirds of total U.S. exports in 2002 was shipped to Canada and Mexico. Shipments of aluminum scrap to China accounted for an additional 13% of total exports.

Imports for consumption increased compared with those of the previous year (table 10), reversing a 2-year downward trend. Canada remained the major source country, supplying more than one-half of the total imports in 2002 (table 11). Russia continued to be the second largest supplier of aluminum materials to the United States.

## World Review

World production of primary aluminum metal increased 7% in 2002 compared with that of 2001 (table 12). Most of the production increase was from new or expanded facilities in China. The estimated Chinese primary production has more than doubled compared with that of 1997.

Unwrought aluminum inventories held by members of the IAI decreased to 1.66 Mt at yearend 2002 from 1.74 Mt at yearend 2001. Unwrought aluminum is defined by the IAI as aluminum in its basic form made from primary metal or from scrap that is unworked in the metallurgical sense. IAI total aluminum inventories decreased to 2.93 Mt at yearend 2002 from 3.02 Mt at yearend 2001. Total aluminum is unwrought aluminum plus unprocessed scrap, metal in process, and finished semifabricated (mill) products (International Aluminium Institute, 2003).

Yearend 2002 inventories of primary aluminum metal held by the LME increased to 1.24 Mt from 821,000 t at yearend 2001. Aluminum alloy inventories decreased dramatically to 34,700 t at yearend 2002 from 121,000 t at yearend 2001. At yearend 2002, LME warehouses also held 44,200 t of NASAAC ingot (London Metal Exchange Ltd., 2002).

**Industry Mergers.**—Norsk Hydro of Norway purchased VAW Aluminium AG from E.ON AG, the German utility group. The new company will be called Hydro Aluminium AS (Norsk Hydro ASA, 2003, p. 20). VAW's primary aluminum assets included the 210,000-t/yr Norf and 68,000-t/yr Stade smelters in Europe, the 150,000-t/yr Kurri Kurri smelter in New South Wales, and a 12.4% interest in the 460,000-t/yr Tomago smelter, also in New South Wales. VAW also had downstream aluminum assets, most notably a 50% interest in Aluminium Norf GmbH, which owns a 1.2-Mt/yr rolling mill that produced aluminum can sheet (Mining Journal, 2002b). VAW was particularly strong in the area of rolled and cast products, which would complement Norsk Hydro's substantial market position in extruded products and profiles (Norsk Hydro ASA, 2002g). The acquisition made Norsk Hydro the third largest integrated aluminum company in the world, ranking behind Alcoa and Alcan (Platts Metals Week, 2002g).

Corus Group plc, which was formed by the merger of Koninklijke Hoogovens Aluminium and British Steel in 1999, announced plans to sell its aluminum assets—Corus Primary Aluminium, Corus Aluminium Rolled Products, and Corus Aluminium Extrusions (Metal Bulletin, 1999). Corus Primary operated two smelters, the 100,000-t/yr Delfzijl smelter in the Netherlands and the 86,000-t/yr Voerde smelter in Germany. Corus also held a 20% interest in the Alouette smelter in Canada. (More information can be found under

the Canada section.) Corus Rolled Products operated rolling mills in Koblenz, Germany, and Duffel, Belgium, and had a 60% interest in the Cap de la Madeleine mill in Canada. Corus Extrusions had plants in Belgium, China, and Germany (Corus Group plc, 2002a). On October 23, Corus Group agreed in principle to sell its rolled products and extrusions businesses to Pechiney pending approval of shareholders and appropriate regulatory authorities (Corus Group plc, 2002b). On March 11, 2003, however, Corus Group announced that the proposed sale to Pechiney had been rejected by the supervisory board of Corus Nederland BV (a wholly owned subsidiary of Corus Group) (Corus Group plc, 2003a). A subsequent court appeal was also rejected. As a result, Corus Group informed Pechiney that it had no further redress and would not proceed with the proposed sale (Corus Group plc, 2003b).

**Armenia.**—The Armenian Government approved the sale of its 26% of the Armenian-Russian joint-venture foil mill, Armenal, to Russian Aluminum (RusAl) making RusAl the sole owner of the plant. RusAl reportedly agreed to pay \$500,000 for the share package and to invest \$34 million in the company during the next 10 years (Interfax Mining & Metals Report, 2002). Following completion of the latest upgrade to the mill in April 2002, capacity increased to approximately 23,000 t/yr of foil (Henry, 2002).

**Australia.**—Comalco Limited (a wholly owned subsidiary of Rio Tinto plc.) purchased Kobe Steel Ltd.'s interest in the 490,000-t/yr Boyne Island primary aluminum smelter in Gladstone. Comalco's ownership share in the smelter increased from 54.19% to 59.39%. The remainder of the smelter is held by other Japanese interests (Rio Tinto plc., 2002). Expansion plans to increase capacity at the smelter to 700,000-t/yr, announced in 2001, have been deferred and will be reevaluated as aluminum market conditions improve (Platts Metals Week, 2002c).

Norsk Hydro announced plans to install new technology on two potlines of the Kurri Kurri aluminum smelter in Hunter Valley, New South Wales. The upgrade would increase capacity at the primary smelter by 10% to 165,000 t/yr and improve the plant's environmental performance. The project was expected to be completed in about 3 years (Norsk Hydro ASA, 2002h).

The joint-venture partners in the 460,000-t/yr Tomago primary aluminum smelter near Newcastle, New South Wales, have agreed to expand production capacity by 70,000 t/yr by increasing the current intensity of the smelter's pots to 225,000 amps. Participants in the smelter are Pechiney (51.55%), Gove Aluminium Finance Ltd. (36.05%), and Norsk Hydro (12.4%). The first incremental increase in production was expected to occur in 2004, and the targeted capacity of 530,000 t/yr should be reached in 2006 (Pechiney, 2002d).

**Bahrain.**—Aluminium Bahrain (Alba) signed an agreement with Pechiney to use Pechiney AP30 technology on its Line 5 aluminum expansion project. The new 307,000-t/yr potline would have 336 cells and, upon completion, would increase capacity at the 520,000-t/yr smelter to more than 800,000 t/yr. Alba was also evaluating technical bids for the construction of a 650 megawatt (MW) power station to power the \$1.7 billion Line 5 project. Meanwhile, Alba was preparing a report for its board of directors on a possible alliance with Alcoa and the construction of a 307,000-t/yr sixth potline that would increase capacity at the smelter to more than 1 Mt/yr (Platts Metals Week, 2002a).

**Brazil.**—Energy restrictions in the northern regions of Brazil that began in June 2001 were lifted in January. As a result, the Alumar and the Alumínio Brasileiro S.A. (Albrás) smelters returned to full production. The Albrás smelter restarted 160 pots that were taken offline during the period of energy rationing. In addition, the company started up 45,000 t/yr of new capacity that was completed in December 2001 but could not be put into production until the energy rationing was lifted. Upon completion of the startup, the smelter was operating at its full production capacity of 406,000 t/yr. Alcoa and BHP Billiton restarted the 92,500 t/yr of production capacity that had been taken offline at its 370,000-t/yr Alumar smelter (Metal Bulletin, 2002a).

Energy restrictions in other areas of the country were lifted at the end of February. As a result, Alcan resumed full production at its Ouro Preto and Aratu smelters, which had been operating at reduced levels since June 2001 (Kinch, 2002).

Alcan opened its first South American composites production facility in Camaçari, Bahia State. At capacity, the facility was expected to produce 100,000 square meters per month of aluminum composite material, made with two sheets of aluminum bonded to a thermoplastic core. It is used primarily as exterior cladding on commercial buildings (Alcan Inc., 2002i).

IMCO Recycling Inc. acquired an aluminum recycling plant in the city of Pindamonhangaba, Sao Paulo State, from Reciclagem de Materiais Industria e Comercio Ltda. (Recipar). The facility will be used to meet the terms of a long-term tolling agreement with Alcan, whose can sheet rolling mill is located nearby. The plant has shredding and delacquering equipment and two furnaces with a rated annual processing capacity of 45,400 t (100 million pounds) of scrap (IMCO Recycling Inc., 2002a).

**Canada.**—Alcan officially inaugurated its primary smelter and casting complex at Alma, Quebec. Construction on the Alma smelter began in March 1998, and the first metal was produced in October 2000. The smelter reached its engineered capacity of 400,000 t/yr in 2002 (Alcan Inc., 2002e).

Alcan purchased a 40% interest in the Aluminerie Alouette consortium that operates a 243,000-t/yr smelter in Sept-Îles, Quebec. In April, Alcan completed the purchase of the 20% interest held by Société Générale de Financement (SGF) (Alcan Inc., 2002c). In September, Alcan completed the acquisition of Corus Group's 20% interest in the smelter (Alcan Inc., 2002h). In July, SGF purchased Kobe Steel Ltd.'s 13.33% interest in Alouette (McCulloch, 2002). Norsk Hydro, which acquired a 20% interest in Alouette through its acquisition of VAW, joined the other members of the consortium (Alcan, 40%; Austria Metall AG, 20%; SGF, 13.33%; and Marubeni Corp, 6.67%) in a planned 307,000-t/yr expansion of the smelter, which upon completion would bring total capacity to 550,000 t/yr. Construction began in September and the first production of metal was scheduled for February 2005 (Norsk Hydro ASA, 2002e). The technology selected for the smelter expansion was Pechiney's AP30 technology, the same as that used in the existing smelter. The choice of technology will allow synergy benefits by combining the operation of the smelter's existing 264 electrolytic cells with the 300 additional cells planned for the expansion (Pechiney, 2002a).

Alcoa announced plans for the modernization of its primary aluminum smelter in Baie Comeau, Quebec. The 8-year project will involve the replacement of the plant's Soderberg production technology with a modern prebake technology. Alcoa also plans to

maximize operations in the two units that are already using prebake technology. Upon completion of the project in 2010, production capacity at the plant is expected to increase from 437,000 t/yr to 547,000 t/yr (Alcoa Inc., 2002j).

Alcan announced the restart of 60,000-t/yr of capacity at its Kitimat, British Columbia, smelter. The company had reduced its operating capacity from 277,000 t/yr to 180,000 t/yr in June 2001 in response to a critical water shortage in the Nechako Reservoir, which supplied water to Alcan's power generating station near Kemano, B.C. (Alcan, 2002l).

Alcoa and the Government of Newfoundland and Labrador agreed to terminate discussions begun last year for new hydroelectric plants in the province, which would have supplied power for future aluminum processing facilities. The project is deemed to be uneconomic at this time (Keith, 2002).

Alcan sold its dross processing facility in Quebec to Scepter Aluminum Company, a privately held recycling business based in the United States. Under the terms of the transaction, the Guillaume-Tremblay Works will continue to process the dross produced by Alcan's Quebec smelters (Alcan Inc., 2002d).

**China.**—Alcan announced an agreement in principle to form a joint venture with Qingtongxia Aluminum Company (QTX). Under the proposed joint venture, Alcan would acquire a 50% ownership position in the recently completed 130,000-t/yr primary aluminum smelter in the Ningxia Autonomous Region. In addition, Alcan would have the option to secure a 50% interest in the planned and approved 150,000-t/yr expansion of this smelter (Alcan Inc., 2002a).

Lanzhou Aluminium Co., Ltd. and Pechiney announced an agreement in principle to develop a technical joint venture aimed at constructing a new 260,000-t/yr smelter in Gansu Province. After signing the Letter of Intent, the companies will begin a detailed prefability study in 2003. If the project proves to be clearly profitable, then the companies would create a joint venture in 2004, subject to the formal approval by the relevant Chinese authorities (Pechiney, 2002b).

Meanwhile, Alcoa and Aluminium Corporation of China Limited (Chalco) announced that the formalization of its joint venture at Pingguo would be delayed until 2003 giving both parties more time to complete the necessary commercial terms and to obtain the necessary government approvals. Under the previously announced agreement, the companies would form a 50/50 joint venture at Chalco's Pingguo alumina and aluminum production facilities. The companies have also committed to significant expansions of refining and smelting capacities during the next few years (Alcoa Inc., 2002i).

Emeishan Aluminium Industry Consortium announced the completion of the first phase of its new 300,000-t/yr smelter in Sichuan Province. The first stage capacity was 73,000 t/yr. Subsequent phases were expected to increase capacity to 223,000 t/yr in 2003 and full capacity in 2005. The smelter uses prebake anode technology (American Metal Market, 2002e).

Chalco began trial runs at its new 55,000-t/yr Haixing smelter in Qinghai Province. The plant was expected to reach full production by yearend (American Metal Market, 2002a).

Henan Wanji Aluminium, formerly Xinan Aluminium Plant, reportedly completed a new smelter that increased capacity at its facility from 60,000 t/yr to 180,000 t/yr (American Metal Market, 2002b).

Guangdong Fenglu Aluminium Co. commissioned a new extrusion plant at its facility in Nanhai, Guangdong Province. The new facility, which was in the final stages of trial runs, would add 130,000 t/yr of capacity and increase the combined capacity of the plant's two extrusion lines to 160,000 t/yr (Metal Bulletin, 2002c).

**Czech Republic.**—Nemak SA, headquartered in Monterrey, Mexico, began construction of its first European aluminum casting plant for automotive parts. The new facility, being built in Most, was expected to begin producing parts by late 2003 or early 2004. The size and capacity of the plant were not disclosed but the first castings were expected to be aluminum cylinder heads for Jaguar Cars Ltd. (American Metal Market, 2002f).

Sumitomo Light Metal Industries announced plans to build its first European production facility, also in the Czech Republic. The plant, which will produce extruded aluminum tubes for automotive air-conditioning systems, will be situated near Prague. Production at Sumikei Czech could begin as early as January 2004 (Metal Bulletin, 2002f).

**Egypt.**—Aluminium Company of Egypt announced a 50,000-t/yr expansion at its 190,000-t/yr smelter. The expansion, scheduled for completion in April 2004, included the construction of a new 92-pot potline and the refurbishment of an existing potline (Metal Bulletin, 2002b).

**Germany.**—IMCO exercised its preemptive rights to VAW's 50%-interest in VAW-Imco Guss und Recycling GmbH. VAW-Imco was formed in 1996 and operates two aluminum recycling and foundry alloy plants in Grevenbroich and Töging. The plants supply aluminum alloys to European automakers (IMCO Recycling Inc., 2002b).

Alcan announced that it had signed a definitive agreement with Norsk Hydro to purchase VAW Packaging (FlexPac) (Alcan Inc., 2002f). FlexPac, which included 14 plants in 8 countries, produced flexible packaging products for the food, dairy, and pharmaceutical industries. At the conclusion of the definitive share-purchase agreement, Alcan would waive its preemptive rights with respect to the Alunorf rolling mill in Germany and would terminate the related litigation (Alcan Inc., 2002g).

**Ghana.**—Drought conditions reduced the operating level of the Akosombo Dam hydroelectric plant and forced the Volta River Authority to reduce power allocations to the Volta Aluminum Company Limited (Valco) smelter. As a result, Kaiser, which owns 90% of the 200,000-t/yr smelter, curtailed production in March at a second of the smelter's five potlines. Each of the smelter's potlines has a capacity of about 40,000 t/yr. Kaiser operated four potlines in 2000 and 2001 (Kaiser Aluminum & Chemical Corp., 2002b).

**Iceland.**—Alcoa announced that it signed a memorandum of understanding (MOU) with the Government of Iceland and Landsvirkjun, Iceland's national power company, formalizing its cooperation on a 295,000-t/yr primary aluminum smelter to be built in eastern Iceland. Under the MOU, Landsvirkjun would begin development of a 500 MW hydropower facility in eastern Iceland, and Alcoa would complete environmental and engineering studies of the smelter near Reydarfjörður. The MOU also included construction of a harbor facility at Mjóeyri as well as related infrastructure improvements in the area (Alcoa Inc., 2002d).

**India.**—Indian Aluminium Co. Ltd. increased capacity at its Hirakud smelter by transporting potlines from the company's mothballed Belgaum facility to Hirakud. The smelter's capacity increased to 57,000 t/yr from 30,000 t/yr (Mining Journal, 2002a).

**Italy.**—Alcan announced the sale of its rolled product circles production unit in Pieve Emanuele to Aliberico Group of Madrid, Spain. The circles, manufactured from sheet aluminum, are largely for the kitchenware market (Alcan Inc., 2002j).

**Japan.**—Allis Sanyo (a subsidiary of Honda Trading) commissioned new facilities that would increase its capacity for secondary aluminum alloy production to 3,000 t/mo. Molten metal from Allis Sanyo will be delivered to Honda's motorbike and engine plant in Ozu, Kumamoto (Metal Bulletin, 2002d).

Showa Denko shut five aluminum extrusion presses to bring active capacity closer to actual production levels. Sluggish demand for aluminum sashes, windows, and doors led the company to close down the presses at its Oyama and Sakai plants (Metal Bulletin, 2002e).

Tokai Aluminium Foil commissioned a new foil plant that initially will produce foil for the dairy industry. Throughput at the plant will be about 20 t/mo of primary ingot. Tokai Aluminium is Japan's third largest aluminum foil maker (Metal Bulletin, 2002g).

In March, Alcoa purchased an additional 20.3% interest in Shibazaki Seisakusho Ltd., a manufacturer of plastic and aluminum closures and caps for the beverage and pharmaceutical industries, from The Furukawa Electric Co., Ltd. The acquisition increased Alcoa's holding to 70.8% from its original 50.5% investment, which it had held since 1979. Alcoa then began a tender offer for the remaining shares of Shibazaka (Alcoa Inc., 2002e). Upon acquiring additional shares in the company, Alcoa's ownership stake increased to 95.9% (Alcoa Inc., 2002c).

**Malaysia.**—Gulf International Investment Group (a group of investors from Dubai and Bahrain) signed an agreement for the development of a new 500,000-t/yr aluminum smelter in Sarawak. The smelter would be constructed in two stages of 250,000 t/yr each. BHP Billiton reportedly expressed interest in joining the consortium. The viability of the plan, however, hinged on the construction of the 2,400-MW Bakun Dam hydroelectric powerplant (CRU Aluminium Monitor, 2002).

**Mexico.**—IMCO announced that its joint venture in Monterrey (IMCO Reciclaje de Nuevo Leon S. de R.L. de C.V.) was awarded a long-term contract to recycle aluminum drosses and scrap for Nemak, S.A., a producer of aluminum cylinder heads and engine blocks. To meet the terms of the contract, a new 45,400-t/yr (100-million-pound-per-year) facility was built to upgrade and eventually replace the current operation of equivalent size (IMCO Recycling Inc., 2002c). Note that the annual capacity of the original facility quoted in the aluminum chapter of the 2001 USGS Minerals Yearbook is incorrect.

**Norway.**—In February, Alcoa increased its share of Elkem ASA to 40.2% (Alcoa Inc., 2002a). By November, Alcoa held 46.5% of Elkem's shares (Alcoa Inc., 2002k).

Hydro Aluminium AS (a subsidiary of Norsk Hydro) commissioned the first cells in the new potroom of the Sunndal aluminum smelter. The new potroom is the first phase of the smelter's expansion and modernization project that began in June 2001. Section 1, which consists of 108 cells with a total annual capacity of approximately 76,000 t, was expected to be fully operational early in 2003. Concurrently, the old Soderberg cells, with an annual capacity of 66,000 t, were to be gradually phased out. Section 2 was scheduled for completion in the summer of 2003. A total of 340 cells using Norsk Hydro's proprietary process technology, HAL250, are to be installed. Upon completion of the project in 2004, capacity at the Sunndal smelter would increase to about 330,000 t/yr (Norsk Hydro ASA, 2002a, c).

In response to shortages in Norway's electricity supply, Hydro Aluminium cut aluminum production at its Karmoy smelter by 3,500 t. The reduction coincided with the seasonal slowdown in demand for extrusion ingot expected early in 2003. The unused power was sold back to the Norwegian electricity grid. Rising electricity prices also forced Hydro Aluminium to close redundant Soderberg capacity at its Sunndal smelter sooner than originally planned, cutting production by 1,400 t (American Metal Market, 2002c).

In an effort to ease the country's escalating power crisis, Norsk Hydro agreed to purchase 300 MW of electricity from Russian energy producer Unified Energy System. Reduced autumn rainfall led to diminished reservoir levels at hydroelectric plants. The additional power, to be delivered in January 2003 through Finland to the joint Nordic electricity grid, will be sold by Norsk Hydro's energy arm to the domestic market to improve the power balance in the region (American Metal Market, 2002g).

**Qatar.**—United Development Co. (UDC), a private investment company in Qatar, announced plans to build a 500,000-t/yr primary aluminum smelter in the Ras Laffan industrial area. The smelter could be expanded in stages to a capacity of up to 1 Mt/yr. UDC is developing the smelter under contract from the Qatari Government (Cooper, 2002).

**Romania.**—A consortium formed by U.S.-based trader Marco International, its Romanian subsidiary Conef SA, and Marco Acquisitions purchased a 10% interest in the 175,000-t/yr ALRO SA (Slatina) primary aluminum smelter. The purchase gave Marco controlling interest (roughly 54%) of the company's outstanding shares (American Metal Market, 2002i; Guerriere, 2002c).

Later in the year, Marco purchased a controlling interest (69.9%) in the Aprom SA aluminum rolling mill from the Romanian Government for \$4 million and pledged to invest an additional \$9.9 million in mill improvements. The mill reportedly produces bars, pipes, and plates (American Metal Market, 2002h).

**Russia.**—Norsk Hydro and RusAl entered into a long-term agreement for the production and sourcing of high-grade aluminum extrusion ingots. Norsk Hydro will participate in a two-stage upgrade of the Sayanogorsk smelter cast house. Norsk Hydro will provide its own proprietary casting equipment, which RusAl will use to supply extrusion ingots back to Norsk Hydro. The first stage, scheduled for completion by yearend 2003, would add 80,000 t/yr of extrusion ingot casting capacity. The second stage, to follow a few years later, would bring casting capacity up to 160,000 t/yr (Norsk Hydro ASA, 2002f).

**South Africa.**—BHP Billiton approved the Hillside aluminum smelter expansion project Hillside 3. The \$449 million project will add 132,000 t/yr of capacity to the 515,000-t/yr smelter at Richards Bay, which was completed in 1996. Construction began in April, commissioning was scheduled for April 2004, and full production was expected in mid-2004. Hillside 3 will include a third potline

(half the size of the existing two potlines), an anode-baking furnace, additional casting facilities, and all necessary related infrastructure. The expansion, like the existing smelter, will use Pechiney AP30 technology (BHP Billiton, 2002).

**Spain.**—Norsk Hydro opened its new aluminum remelt and recycling plant at Azuqueca de Henares, near Madrid. The plant has the capacity to produce 60,000 t/yr of extrusion ingot from aluminum scrap (Platts Metals Week, 2002f).

**Sweden.**—Elkem ASA's wholly owned subsidiary (Elkem Sweden AB) increased its share in the Swedish aluminum semifabricator, Sapa AB, from 36% to 71.4% (Elkem ASA, 2002).

Stena Aluminium AS completed the installation of two new rotary furnaces at its secondary smelter in Älmhult. Each new furnace has the capacity to melt 25,000 t/yr of aluminum scrap. The project has increased the plant's melt capacity from 30,000 t/yr (Conway, 2002).

**Ukraine.**—Ukrainskiy Aluminiiy (UkrAl) (a subsidiary of RusAl) reportedly began construction on a 120,000-t/yr primary aluminum smelter in the city of Pervomaysk. The \$300 million project was part of an investment commitment made by RusAl in March 2000 when it purchased a 30% interest in Ukraine's Nikolayev Alumina Plant (Platts Metals Week, 2002i).

**United Arab Emirates.**—Dubai Aluminium Company Ltd. (Dubal) received approval for a refurbishment project, the Kestrel project, which would increase capacity at the 536,000-t/yr smelter to more than 700,000 t/yr. The project involves the upgrading and extension of Dubal's initial three potlines and the extension of its more recent fourth potline. Work was expected to be completed by 2006 (Platts Metals Week, 2002d).

## Outlook

World aluminum supply probably will continue to outstrip demand. Although many industry observers believe that there could be significant growth in aluminum demand during the next few years, supply expansions, especially in China, were expected to more than meet the increase in demand.

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TABLE 1  
SALIENT ALUMINUM STATISTICS<sup>1</sup>

		1998	1999	2000	2001	2002
United States:						
Primary production						
Quantity	thousand metric tons	3,713	3,779	3,668	2,637	2,707
Value	millions	\$5,360	\$5,470	\$6,030	\$4,000	\$3,870
Price, average, U.S. market, spot	cents per pound	65.5	65.7	74.6	68.8	64.9
Inventories (December 31):						
Aluminum industry <sup>2</sup>	thousand metric tons	1,930	1,870	1,550	1,300	1,320
LME stocks in U.S. warehouses <sup>3</sup>	do.	13	14	(4)	28	45
Secondary recovery: <sup>5</sup>		3,440	3,700	3,450	2,970 <sup>r</sup>	2,930
New scrap	do.	1,950	2,120	2,080	1,760 <sup>r</sup>	1,750
Old scrap	do.	1,500	1,570	1,370	1,210 <sup>r</sup>	1,170
Exports, crude and semicrude	do.	1,590	1,650	1,760	1,590	1,590
Imports for consumption, crude and semicrude	do.	3,550	4,000	3,910	3,740	4,060
Supply, apparent <sup>6</sup>	do.	9,040	9,890	9,610	7,990 <sup>r</sup>	8,060
Consumption, apparent <sup>7</sup>	do.	7,090	7,770	7,530	6,230	6,310
World, production	do.	22,600	23,600	24,400	24,300 <sup>r</sup>	25,900 <sup>e</sup>

<sup>e</sup>Estimated. <sup>r</sup>Revised.

<sup>1</sup>Data are rounded to no more than three significant digits, except "Primary production." Revised as of March 30, 2004.

<sup>2</sup>Includes ingot, semifabricated material, and scrap. 1998 data from Current Industrial Reports, Series M33-D, U.S. Department of Commerce, U.S. Census Bureau; 1999 through 2002 data from the Aluminum Association Inc.

<sup>3</sup>Includes aluminum alloyed material.

<sup>4</sup>Less than 1/2 unit.

<sup>5</sup>Metallic recovery from purchased, tolled, or imported new and old scrap expanded for full industry coverage.

<sup>6</sup>Defined as domestic primary metal production plus secondary recovery plus imports minus exports plus adjustments for Government and industry stock changes.

<sup>7</sup>Apparent supply less recovery from purchased new scrap.

TABLE 2  
PRIMARY ANNUAL ALUMINUM PRODUCTION CAPACITY IN THE UNITED STATES, BY COMPANY<sup>1</sup>

Company	Yearend capacity (thousand metric tons)		2002 ownership
	2001	2002	
Alcan Aluminum Corp., Sebree, KY	196	196	Alcan Inc., 100%.
Alcoa Inc.:			
Alcoa, TN	210	210	Alcoa Inc., 100%.
Badin, NC	120	120	Do.
Evansville, IN (Warrick)	309	309	Do.
Ferndale, WA (Intalco)	278	278	Alcoa Inc., 61%; Mitsui & Co. Ltd., 32%; YKK Corp., 7%.
Frederick, MD (Eastalco)	192	192	Do.
Massena, NY (St. Lawrence)	125	125	Alcoa Inc., 100%.
Massena, NY	130	130	Do.
Mount Holly, SC	212	212	Alcoa Inc., 50.3%; Century Aluminum Co., 49.7%.
Rockdale, TX	340	264	Alcoa Inc., 100%.
Troutdale, OR	121	--	Do.
Wenatchee, WA	227	227	Do.
Total	2,260	2,070	
Century Aluminum Co.:			
Hawesville, KY	237	237	Century Aluminum Co., 80%; Glencore International AG, 20%.
Ravenswood, WV	170	170	Century Aluminum Co., 100%.
Total	407	407	
Columbia Falls Aluminum Co., Columbia Falls, MT	168	168	Glencore International AG, 100%.
Goldendale Aluminum Co., Goldendale, WA	168	168	Private interest, 60%; employees, 40%.
Kaiser Aluminum & Chemical Corp.:			
Mead, WA (Spokane)	200	200	MAXXAM Inc., 100%.
Tacoma, WA <sup>2</sup>	73	--	Do.
Total	273	200	
Longview Aluminum, L.L.C., Longview, WA	204	204	Michigan Avenue Partners, 100%.
Noranda Aluminum Inc., New Madrid, MO	230	250	Noranda Mines Ltd., 100%.
Northwest Aluminum Corp., The Dalles, OR	82	82	Private interest, 100%.
Ormet Primary Aluminum Corp., Hannibal, OH	257	257	Ormet Corp., 100%.
Vanalco Inc., Vancouver, WA	116	116	Glencore International AG, 100%.
Grand total	4,370	4,120	

-- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Sold to Tacoma Port Authority December 2002; scheduled for permanent closure.

TABLE 3

U.S. CONSUMPTION OF AND RECOVERY FROM PURCHASED NEW AND OLD ALUMINUM SCRAP, BY CLASS<sup>1,2</sup>

(Metric tons)

Class	Consumption	Calculated recovery	
		Aluminum	Metallic
2001:			
Secondary smelters	1,630,000 <sup>r</sup>	1,130,000 <sup>r</sup>	1,220,000 <sup>r</sup>
Integrated aluminum companies	946,000	772,000	823,000
Independent mill fabricators	695,000	601,000	642,000
Foundries	89,000	74,800	80,000
Other consumers	12,100	12,100	12,100
Total	3,370,000 <sup>r</sup>	2,590,000 <sup>r</sup>	2,770,000 <sup>r</sup>
Estimated full industry coverage	3,610,000 <sup>r</sup>	2,770,000 <sup>r</sup>	2,970,000 <sup>r</sup>
2002:			
Secondary smelters	1,680,000	1,130,000	1,220,000
Integrated aluminum companies	869,000	707,000	752,000
Independent mill fabricators	698,000	607,000	648,000
Foundries	112,000	95,300	102,000
Other consumers	8,320	8,250	8,250
Total	3,370,000	2,550,000	2,730,000
Estimated full industry coverage	3,620,000	2,730,000	2,930,000

<sup>r</sup>Revised.<sup>1</sup>Excludes recovery from other than aluminum-base scrap.<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 4  
U.S. STOCKS, RECEIPTS, AND CONSUMPTION OF PURCHASED NEW AND OLD ALUMINUM SCRAP  
AND SWEATED PIG IN 2002<sup>1, 2</sup>

(Metric tons)

Class of consumer and type of scrap	Stocks, January 1	Net receipts <sup>3</sup>	Consumption	Stocks, December 31
<b>Secondary smelters:</b>				
New scrap:				
Solids	19,300 <sup>r</sup>	250,000	258,000	11,600
Borings and turnings	4,370 <sup>r</sup>	230,000	229,000	4,930
Dross and skimmings	3,090 <sup>r</sup>	502,000	500,000	5,020
Other <sup>4</sup>	1,060 <sup>r</sup>	178,000	178,000	616
Total	27,900 <sup>r</sup>	1,160,000	1,170,000	22,100
Old scrap:				
Castings, sheet, clippings	6,090 <sup>r</sup>	301,000	298,000	8,870
Aluminum-copper radiators	1,710 <sup>r</sup>	17,900	18,000	1,550
Aluminum cans <sup>5</sup>	1,390	93,100	93,600	838
Other <sup>6</sup>	5,670 <sup>r</sup>	92,400	96,800	1,310
Total	14,900 <sup>r</sup>	504,000	506,000	12,600
Sweated pig	151 <sup>r</sup>	9,370	8,950	567
Total secondary smelters	42,900 <sup>r</sup>	1,670,000	1,680,000	35,300
<b>Integrated aluminum companies, foundries, independent mill fabricators, other consumers:</b>				
New scrap:				
Solids	9,160 <sup>r</sup>	709,000	700,000	18,000
Borings and turnings	352	19,600	19,500	465
Dross and skimmings	148	5,340	5,320	163
Other <sup>4</sup>	7,770	176,000	177,000	6,150
Total	17,400 <sup>r</sup>	909,000	902,000	24,800
Old scrap:				
Castings, sheet, clippings	4,210	131,000	131,000	4,880
Aluminum-copper radiators	324	4,820	4,780	361
Aluminum cans <sup>5</sup>	31,500	616,000	619,000	27,900
Other <sup>6</sup>	22	29,800	29,800	22
Total	36,000	782,000	785,000	33,100
Sweated pig	33	1,130	1,140	22
Total integrated aluminum companies, etc.	53,500 <sup>r</sup>	1,690,000	1,690,000	57,900
<b>All scrap consumed:</b>				
New scrap:				
Solids	28,500 <sup>r</sup>	959,000	958,000	29,500
Borings and turnings	4,720 <sup>r</sup>	250,000	249,000	5,400
Dross and skimmings	3,240 <sup>r</sup>	507,000	505,000	5,180
Other <sup>4</sup>	8,840 <sup>r</sup>	353,000	355,000	6,760
Total	45,300 <sup>r</sup>	2,070,000	2,070,000	46,900
Old scrap:				
Castings, sheet, clippings	10,300 <sup>r</sup>	432,000	429,000	13,700
Aluminum-copper radiators	2,030 <sup>r</sup>	22,700	22,800	1,910
Aluminum cans	32,900	709,000	713,000	28,700
Other <sup>6</sup>	5,690 <sup>r</sup>	122,000	127,000	1,330
Total	50,900 <sup>r</sup>	1,290,000	1,290,000	45,700
Sweated pig	184 <sup>r</sup>	10,500	10,100	589
Total of all scrap consumed	96,300 <sup>r</sup>	3,370,000	3,370,000	93,200

<sup>r</sup>Revised.

<sup>1</sup>Includes imported scrap. According to reporting companies, 8.08% of total receipts of aluminum-base scrap, or 278,000 metric tons, was received on toll arrangements.

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Includes inventory adjustment.

<sup>4</sup>Includes data on foil, can stock clippings, and other miscellaneous.

<sup>5</sup>Used beverage cans toll treated for primary producers are included in secondary smelter tabulation.

<sup>6</sup>Includes municipal wastes (including litter) and fragmentized scrap (auto shredder).

TABLE 5  
PRODUCTION AND SHIPMENTS OF SECONDARY ALUMINUM ALLOYS BY INDEPENDENT SMELTERS  
IN THE UNITED STATES<sup>1</sup>

(Metric tons)

	2001		2002	
	Production	Net shipments <sup>2</sup>	Production	Net shipments <sup>2</sup>
Diecast alloys:				
13% Si, 360, etc. (0.6% Cu, maximum)	21,000 <sup>r</sup>	22,200 <sup>r</sup>	24,300	25,200
380 and variations	385,000 <sup>r</sup>	388,000 <sup>r</sup>	384,000	379,000
Sand and permanent mold:				
95/5 Al-Si, 356, etc. (0.6% Cu, maximum)	57,200 <sup>r</sup>	58,100 <sup>r</sup>	49,100	61,800
No. 319 and variations	116,000 <sup>r</sup>	121,000 <sup>r</sup>	128,000	134,000
F-132 alloy and variations	24,300	25,000	27,700	27,300
Al-Mg alloys	639	639	1,190	1,180
Al-Zn alloys	1,780	1,940	2,080	3,020
Al-Si alloys (0.6% to 2.0% Cu)	2,020	2,020	634	614
Al-Cu alloys (1.5% Si, maximum)	2,290	2,290	3,460	3,590
Al-Si-Cu-Ni alloys	949	950	45	38
Other	1,340	1,320 <sup>r</sup>	938	975
Wrought alloys, extrusion billets	209,000 <sup>r</sup>	206,000 <sup>r</sup>	240,000	240,000
Miscellaneous:				
Steel deoxidation	W	W	W	W
Pure (97.0% Al)	W	W	W	W
Aluminum-base hardeners	3,470	3,470	3,380	3,380
Other <sup>3</sup>	104,000 <sup>r</sup>	106,000 <sup>r</sup>	88,000	87,800
Total	929,000 <sup>r</sup>	939,000 <sup>r</sup>	954,000	968,000
Less consumption of materials other than scrap:				
Primary aluminum	70,900	XX	97,700	XX
Primary silicon	42,100 <sup>r</sup>	XX	43,400	XX
Other	7,630 <sup>r</sup>	XX	9,040	XX
Net metallic recovery from aluminum scrap and sweated pig consumed in production of secondary aluminum ingot <sup>4</sup>	808,000 <sup>r</sup>	XX	804,000	XX

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included with "Miscellaneous, other." XX Not applicable.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes inventory adjustment.

<sup>3</sup>Includes other die-cast alloys.

<sup>4</sup>No allowance made for melt-loss of primary aluminum and alloying ingredients.

TABLE 6  
DISTRIBUTION OF END-USE SHIPMENTS OF ALUMINUM PRODUCTS  
IN THE UNITED STATES AND CANADA, BY INDUSTRY<sup>1, 2</sup>

Industry	2001		2002	
	Quantity (thousand metric tons)	Percentage of grand total	Quantity (thousand metric tons)	Percentage of grand total
Containers and packaging	2,250	22.0	2,260	21.1
Building and construction	1,500	14.6	1,560	14.6
Transportation	3,190	31.2	3,410	31.8
Electrical	686	6.7	677	6.3
Consumer durables	681	6.7	722	6.8
Machinery and equipment	641	6.3	616	5.8
Other markets	367	3.6	390	3.6
Total to domestic users	9,310	91.2	9,640	90.0
Exports <sup>e</sup>	902	8.8	1,070	10.0
Grand total	10,200	100.0	10,700	100.0

<sup>e</sup>Estimated.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Data series revised to include shipments in both the United States and Canada.

Source: The Aluminum Association Inc.



TABLE 7  
U.S. NET SHIPMENTS OF ALUMINUM WROUGHT AND CAST PRODUCTS,  
BY PRODUCERS<sup>1, 2</sup>

(Thousand metric tons)

	2000	2001	2002
Wrought products:			
Sheet, plate, foil	4,840	4,380 <sup>r</sup>	4,510
Pipe, tube, extruded shapes	1,640	1,460 <sup>r</sup>	1,450
Rod, bar, wire, cable	592 <sup>r</sup>	354 <sup>r</sup>	369
Forgings (including impacts)	106	87 <sup>r</sup>	89
Powder, flake, paste	59	56	56
Total	7,240 <sup>r</sup>	6,330 <sup>r</sup>	6,470
Castings:			
Sand	152 <sup>r</sup>	124	NA
Permanent and semipermanent mold	549 <sup>r</sup>	489	NA
Die	991 <sup>r</sup>	871	NA
Other	156 <sup>r</sup>	167	NA
Total	1,850 <sup>r</sup>	1,650	NA
Grand total	9,080 <sup>r</sup>	7,980	NA

<sup>r</sup>Revised. NA Not available.

<sup>1</sup>Net shipments derived by subtracting the sum of producers' domestic receipts of each mill shape from the domestic industry's gross shipments of that shape.

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

Sources: The Aluminum Association Inc. and U.S. Department of Commerce.

TABLE 8  
U.S. EXPORTS OF ALUMINUM, BY COUNTRY<sup>1</sup>

Country or territory	Metals and alloys, crude		Plates, sheets, bars, etc. <sup>2</sup>		Scrap		Total	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2001:								
Brazil	530	\$914	42,000	\$125,000	12	\$10	42,600	\$126,000
Canada	87,000	134,000	459,000	1,170,000	215,000	206,000	761,000	1,510,000
China	270	1,370	33,300	88,000	177,000	156,000	210,000	246,000
France	161	454	7,130	35,000	--	--	7,290	35,500
Germany	987	9,800	2,530	17,900	1,740	7,490	5,250	35,200
Hong Kong	1,510	2,580	2,020	14,400	11,400	16,300	14,900	33,300
Italy	29	117	2,120	13,800	258	189	2,410	14,100
Japan	8,580	19,200	9,420	85,800	23,700	26,400	41,700	131,000
Korea, Republic of	1,880	4,170	13,500	59,300	50,600	54,500	66,000	118,000
Mexico	85,700	131,000	131,000	416,000	52,100	64,000	269,000	610,000
Netherlands	83	471	2,190	10,700	161	199	2,430	11,400
Philippines	51	160	764	3,240	--	--	815	3,400
Russia	9	106	578	2,480	--	--	588	2,590
Saudi Arabia	107	225	9,320	24,300	19	4	9,450	24,600
Singapore	40	176	2,930	12,600	122	269	3,090	13,100
South Africa	4	13	169	1,090	13	150	187	1,250
Taiwan	335	927	5,200	21,700	28,500	29,100	34,000	51,700
Thailand	1,250	1,840	11,000	28,800	1,250	1,900	13,500	32,600
United Kingdom	726	4,590	15,200	96,000	2,950	4,490	18,900	105,000
Venezuela	21	82	12,600	31,900	107	511	12,700	32,500
Other <sup>3</sup>	2,610	8,090	51,700	219,000	15,500	19,900	69,800	247,000
Total	192,000	320,000	814,000	2,480,000	580,000	588,000	1,590,000	3,390,000
2002:								
Brazil	116	328	29,300	79,700	18	18	29,500	80,000
Canada	97,800	158,000	471,000	1,180,000	202,000	193,000	771,000	1,530,000
China	114	551	32,300	75,100	206,000	170,000	238,000	245,000
France	113	272	5,120	30,400	8	110	5,240	30,700
Germany	1,410	9,440	2,810	23,300	264	965	4,480	33,700
Hong Kong	162	1,200	4,060	13,600	8,190	10,500	12,400	25,400
Italy	14	90	1,960	9,600	39	55	2,010	9,740
Japan	3,350	10,100	9,060	64,000	27,100	31,100	39,600	105,000
Korea, Republic of	725	1,970	7,540	35,100	43,900	48,200	52,200	85,300
Mexico	98,800	143,000	114,000	367,000	85,300	107,000	299,000	617,000
Netherlands	129	791	800	4,930	314	961	1,240	6,680
Philippines	1	15	560	2,510	--	--	560	2,520
Russia	19	53	30	387	9	5	58	445
Saudi Arabia	(3)	4	14,500	32,800	--	--	14,500	32,800
Singapore	239	897	2,040	9,630	194	236	2,470	10,800
South Africa	61	282	142	810	--	--	204	1,090
Taiwan	233	1,280	6,430	17,200	27,200	28,300	33,800	46,700
Thailand	1	34	8,940	23,800	831	680	9,780	24,600
United Kingdom	647	3,110	8,890	64,800	661	941	10,200	68,800
Venezuela	6	54	7,900	19,700	1	6	7,900	19,800
Other	1,630	5,920	38,800	161,000	11,600	11,500	52,000	178,000
Total	206,000	337,000	766,000	2,220,000	613,000	603,000	1,590,000	3,160,000

<sup>1</sup>Revised. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes castings, forgings, and unclassified semifabricated forms.

<sup>3</sup>Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 9  
U.S. EXPORTS OF ALUMINUM, BY CLASS<sup>1</sup>

Class	2001		2002	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Crude and semicrude:				
Metals and alloys, crude	192,000	\$320,000	206,000	\$337,000
Scrap	580,000	588,000	613,000	603,000
Plates, sheets, bars, strip, etc.	751,000	2,120,000	706,000	1,880,000
Castings and forgings	18,100	149,000	19,200	132,000
Semifabricated forms, n.e.c.	44,500	215,000	41,500	205,000
Total	1,590,000	3,390,000	1,590,000	3,160,000
Manufactures:				
Foil and leaf	59,200	225,000	60,800	213,000
Powders and flakes	8,660	40,100	8,850	40,100
Wire and cable	28,300	84,100	30,800	76,700
Total	96,200	349,000	100,000	330,000
Grand total	1,680,000	3,740,000	1,690,000	3,490,000

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 10  
U.S. IMPORTS FOR CONSUMPTION OF ALUMINUM, BY CLASS<sup>1</sup>

Class	2001		2002	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Crude and semicrude:				
Metals and alloys, crude	2,560,000	\$3,930,000	2,790,000	\$4,040,000
Plates, sheets, strip, etc., n.e.c. <sup>2</sup>	553,000	1,320,000	630,000	1,410,000
Pipes, tubes, etc.	16,400	90,400	17,000	94,900
Rods and bars	114,000	352,000	149,000	417,000
Scrap	497,000	552,000	466,000	502,000
Total	3,740,000	6,250,000	4,060,000	6,460,000
Manufactures:				
Foil and leaf <sup>3</sup>	86,600	306,000	105,000	337,000
Powders and flakes	5,360	16,300	3,570	14,200
Wire	91,700	162,000	118,000	190,000
Total	184,000	484,000	227,000	541,000
Grand total	3,920,000	6,740,000	4,280,000	7,000,000

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes plates, sheets, circles, and disks.

<sup>3</sup>Excludes etched capacitor foil.

Source: U.S. Census Bureau.

TABLE 11  
U.S. IMPORTS FOR CONSUMPTION OF ALUMINUM, BY COUNTRY<sup>1</sup>

Country	Metals and alloys, crude		Plates, sheets, bars, etc. <sup>2</sup>		Scrap		Total	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
2001:								
Argentina	53,800	\$88,000	105	\$216	2,840	\$3,910	56,700	\$92,100
Australia	121,000	188,000	125	549	18	12	121,000	189,000
Bahrain	8,210	13,200	16,100	32,600	--	--	24,300	45,800
Belgium	60	279	3,210	10,100	37	52	3,310	10,400
Brazil	35,000	55,500	4,360	8,810	20,900	29,700	60,200	94,000
Canada	1,670,000	2,590,000	405,000	928,000	283,000	315,000	2,360,000	3,830,000
China	1,620	2,760	6,870	20,500	447	776	8,940	24,000
France	691	4,810	5,250	23,000	7,840	6,810	13,800	34,600
Germany	677	4,300	50,300	189,000	7,140	7,490	58,200	200,000
Italy	(3)	8	2,730	11,000	62	61	2,790	11,100
Japan	501	1,020	11,100	47,400	386	693	12,000	49,100
Korea, Republic of	766	1,380	6,810	20,600	59	142	7,630	22,100
Mexico	3,930	6,190	16,500	67,000	67,000	70,100	87,400	143,000
Netherlands	644	1,940	2,490	7,420	2,710	4,620	5,840	14,000
Norway	7,850	13,300	1,160	1,910	1,680	2,970	10,700	18,200
Panama	--	--	972	3,040	5,820	6,070	6,790	9,110
Russia	377,000	533,000	37,700	81,300	39,700	45,200	454,000	660,000
Slovenia	--	--	3,350	10,600	--	--	3,350	10,600
South Africa	19,400	27,700	26,300	62,800	31	42	45,800	90,500
Spain	802	1,130	71	867	37	26	910	2,030
Ukraine	11,000	19,300	1	4	840	970	11,800	20,300
United Arab Emirates	62,500	105,000	--	--	3,140	3,470	65,600	109,000
United Kingdom	3,660	7,740	11,900	46,900	4,290	4,190	19,900	58,800
Venezuela	159,000	236,000	17,400	33,200	7,890	7,640	184,000	277,000
Other <sup>f</sup>	23,200	33,400	52,900	161,000	41,900	41,900	118,000	236,000
Total	2,560,000	3,930,000	683,000	1,770,000	497,000	552,000	3,740,000	6,250,000
2002:								
Argentina	82,300	118,000	773	1,290	479	579	83,500	120,000
Australia	95,500	139,000	108	785	125	130	95,700	140,000
Bahrain	18,200	26,500	19,100	36,800	--	--	37,200	63,300
Belgium	(3)	5	8,670	20,800	450	691	9,120	21,500
Brazil	41,000	61,600	2,910	5,390	14,800	19,400	58,700	86,300
Canada	1,580,000	2,320,000	453,000	997,000	293,000	312,000	2,330,000	3,630,000
China	562	1,130	16,500	45,800	1,220	820	18,300	47,800
France	1,160	5,900	6,280	23,400	3,520	3,100	11,000	32,400
Germany	2,360	8,260	61,000	205,000	4,970	4,830	68,300	218,000
Italy	80	122	2,520	9,820	42	45	2,640	9,980
Japan	548	1,150	9,150	39,800	249	769	9,950	41,700
Korea, Republic of	3,510	5,160	5,450	14,500	99	135	9,060	19,800
Mexico	4,690	8,670	15,100	63,600	62,000	61,300	81,800	134,000
Netherlands	440	1,460	2,710	8,310	1,570	2,080	4,730	11,900
Norway	3,810	6,170	125	433	--	--	3,930	6,600
Panama	--	--	801	2,560	3,710	3,670	4,510	6,230
Russia	634,000	863,000	60,800	110,000	25,400	33,600	720,000	1,010,000
Slovenia	1	16	3,390	8,860	--	--	3,390	8,870
South Africa	15,900	21,300	31,900	72,300	8	4	47,800	93,600
Spain	624	1,450	244	1,300	--	--	868	2,750
Ukraine	--	--	20	30	--	--	20	30
United Arab Emirates	61,200	95,400	--	--	777	841	61,900	96,300
United Kingdom	1,230	1,930	7,870	29,000	4,490	4,860	13,600	35,700
Venezuela	203,000	294,000	21,800	36,000	7,330	6,580	232,000	337,000
Other	39,800	56,900	66,100	186,000	41,800	46,300	148,000	289,000
Total	2,790,000	4,040,000	797,000	1,920,000	466,000	502,000	4,060,000	6,460,000

<sup>f</sup>Revised. -- Zero.

<sup>1</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Includes circles, disks, rods, pipes, tubes, etc.

<sup>3</sup>Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 12  
ALUMINUM, PRIMARY: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Thousand metric tons)

Country	1998	1999	2000	2001	2002e
Argentina	187	206	262	245 <sup>r, e</sup>	250
Australia	1,627	1,718	1,769	1,798	1,836 <sup>3</sup>
Bahrain	501	503	509	522 <sup>r</sup>	517
Bosnia and Herzegovina <sup>e, 4</sup>	28	70	95 <sup>r</sup>	96 <sup>r</sup>	104
Brazil	1,208	1,250	1,271	1,131	1,318 <sup>3</sup>
Cameroon	82 <sup>e</sup>	90 <sup>r</sup>	96 <sup>r</sup>	81	80
Canada	2,374	2,390	2,373	2,583	2,709 <sup>3</sup>
China <sup>e</sup>	2,340	2,530	2,800	3,250	4,300
Croatia <sup>4</sup>	16	14	14	15 <sup>e</sup>	15
Egypt	195	193	193 <sup>e</sup>	189 <sup>r, e</sup>	190
France	424	455	441	462	450
Germany	612	634	644	652	650
Ghana	56	104	156	162	132
Greece	146	170	168	163 <sup>e</sup>	165
Hungary	35	34	34 <sup>r</sup>	35 <sup>e</sup>	35
Iceland <sup>5</sup>	173	220 <sup>r</sup>	224 <sup>r</sup>	243	264
India <sup>6</sup>	542	614	644	624 <sup>r</sup>	650
Indonesia <sup>e, 6</sup>	133	106	160	180	160
Iran	124	137	140 <sup>e</sup>	140 <sup>e</sup>	130
Italy	187	187	189	187	180
Japan <sup>7</sup>	16	11	7	7 <sup>e</sup>	7
Mexico <sup>6</sup>	62	63	61 <sup>r</sup>	52 <sup>r</sup>	60
Mozambique	--	--	54	266	273 <sup>3</sup>
Netherlands	264 <sup>e</sup>	286	302	294	300
New Zealand	318	327	328	322	335
Nigeria <sup>e</sup>	20	16	--	--	--
Norway	996	1,020	1,026	1,068	1,096 <sup>3</sup>
Poland <sup>8</sup>	54	51	47	45 <sup>r</sup>	50
Romania <sup>9</sup>	174	174	179	182 <sup>r</sup>	180
Russia	3,005	3,146	3,245	3,300 <sup>e</sup>	3,347 <sup>3</sup>
Serbia and Montenegro <sup>4</sup>	60	73	88	100 <sup>r</sup>	104 <sup>3</sup>
Slovakia <sup>6</sup>	108	109	110	110 <sup>e</sup>	112
Slovenia <sup>4</sup>	74	77	100	100 <sup>e</sup>	88
South Africa	677	689	673 <sup>r</sup>	662 <sup>r</sup>	676 <sup>3</sup>
Spain	362	364	366	376	380
Suriname <sup>e</sup>	29 <sup>3</sup>	6	--	--	--
Sweden	96	99	101	102	101
Switzerland	32	34	35 <sup>e</sup>	35 <sup>e</sup>	36
Tajikistan	196	229	300	289 <sup>r</sup>	308
Turkey <sup>e</sup>	62	62	61 <sup>r</sup>	61 <sup>r</sup>	62
Ukraine <sup>9</sup>	107	115	119	106 <sup>r</sup>	112
United Arab Emirates, Dubai <sup>e</sup>	352 <sup>3</sup>	440	470	500	536
United Kingdom	258	272	305	341	340
United States	3,713	3,779	3,668	2,637	2,707 <sup>3</sup>
Venezuela	585	570	569	571 <sup>r, e</sup>	570
Total	22,600	23,600	24,400	24,300 <sup>r</sup>	25,900

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

<sup>1</sup>World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2</sup>Primary aluminum is defined as "The weight of liquid aluminum as tapped from pots, excluding the weight of any alloying materials as well as that of any metal produced from either returned scrap or remelted materials." International reporting practices vary from country to country, some nations conforming to the foregoing definition and others using different definitions. For those countries for which a different definition is given specifically in the source publication, that definition is provided in this table by footnote. Table includes data available through May 9, 2003.

<sup>3</sup>Reported figure.

<sup>4</sup>Primary ingot plus secondary ingot.

<sup>5</sup>Ingot and rolling billet production.

<sup>6</sup>Primary ingot.

<sup>7</sup>Excludes high-purity aluminum containing 99.995% or more as follows, in metric tons: 1998--35,063; 1999--34,893; 2000--40,956; 2001--26,586; and 2002--25,000 (estimated).

<sup>8</sup>Primary unalloyed ingot plus secondary unalloyed ingot.

<sup>9</sup>Primary unalloyed metal plus primary alloyed metal, thus including weight of alloying material.